Notes From Penguin Ranch

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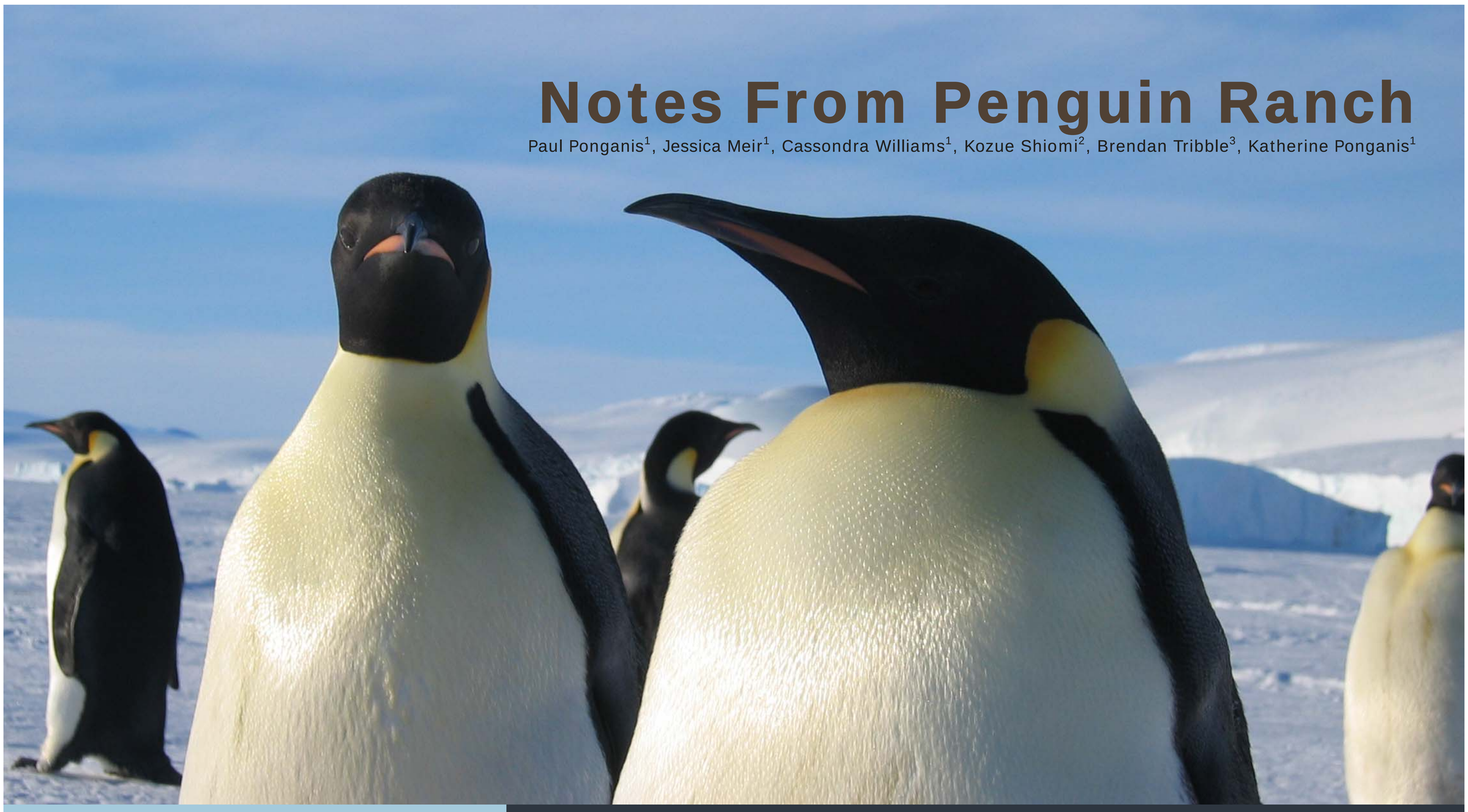

Ongoing Projects

OXYGEN AFFINITY OF HEMOGLOBIN

MUSCLE OXYGEN DEPLETION

CONCENTRATION OF FUEL STORES

3D PROFILES OF DIVING

DOCUMENTING PREY CAPTURE

POPULATION CENSUS

Why is this work important?

The emperor penguin is a keystone species in the Antarctic ecosystem, and yet, there are still many unanswered questions about its ecology and its adaption to the aquatic environment.

Physiology

Emperors penguins routinely dive to depths of 500 meters and can dive as long as 27 minutes on one breath. These birds can deplete the large oxygen stores in their bodies to levels that would be dangerous for humans. During a dive, blood oxygen is consumed slowly because of a low heart rate and decreased tissue perfusion. A high oxygen affinity in their hemoglobin also improves the delivery of oxygen at low partial pressures of oxygen.

During longer dives heart rate can drop to 6 beats per minutes. The low heart rate causes the muscle to use locally-stored oxygen first, and then, to rely upon anaerobic fuel sources to function.

Such adaptations to low oxygen tolerance are potentially relevant to medicine, including treatment of heart attacks and the preservation of organs for transplantation.

Behavior & Ecology

The management of oxygen stores allows this species flexibility in hunting a wide range of prey, as well as, avoiding predation. We are using Penguin Ranch to evaluate two new tools to study dive behavior — a miniature, backpack camera and a 3D dive profile recorder. The camera will eventually allow us to document prey capture during the deep dives of emperor penguins at sea. Similarly, the 3D dive profile recorder will allow us to document the hunting strategy of the emperor penguin during these deep dives.

This species is under pressure in face of habitat alteration due to climate change and overfishing. Knowledge of prey items and hunting strategies is key to the assessment of the long-term survivability and conservation of the emperor penguin.

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